

REMARKS

The application has been amended. In particular, paragraph 0015 of the application has been amended to clarify the description of reference numbers 16 and 24 in Fig. 1 of the drawings. In particular, paragraph 0015 of the application references U.S. Patent No. 6,121,689 and describes Figure 1 of this '689 patent. The paragraph has been amended to incorporate a description of reference numerals 16 and 24 as set forth in the '689 patent. In view of this disclosure in the present application as well as the drawings themselves, no new matter is added through the clarifying amendment to the specification describing these reference numbers.

Additionally, the claims have been amended to further describe the invention. More particularly, claims 1 and 25 have been amended to provide clarifying language regarding positioning of the electrical contacts, as well as to describe the curable thermosetting underfill composition as being dispensed in flowable form and rendered non-flowable on the circuit chip. No new matter has been added within the meaning of 35 U.S.C. § 132.

Claims 1-23, 25-48, and 54-59 have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite, particularly with respect to the phrase "predetermined pattern" in claims 1 and 25 and "controllably degradable" in claim 18. As noted, claims 1 and 25 have been amended to delete the phrase "predetermined pattern", and to clarify that the electrical contacts are arranged on the surface of the chip die. With respect to claim 18, the Examiner contends that the phrase "controllably degradable" is vague and indefinite since "it is not clear what the appropriate conditions are from the claim", and "it is not clear from the claim what is meant by controllably degradable". Applicant submits that definiteness under § 112, second paragraph requires that one skilled in the art understand the language of the claims when read in light of the specification, as the claims must be. *Union Pac. Res. Co. v. Chesapeake Energy Corp.*, 236 F.3d 1625, 57 USPQ2d 1293 (Fed. Cir. 2001). Clearly, the specification provides a clear description as to what is meant by "controllably degradable when exposed to appropriate conditions". In particular, paragraphs 0087-0090 of the present application clearly describe the nature of the materials being controllably degradable under appropriate conditions. In fact the specification provides specific examples of products which are useful for such materials, and which in fact possess such properties of being

controllably degradable when exposed to appropriate conditions. Accordingly, when read in light of the specification, the phrase “controllably degradable when exposed to appropriate conditions” is in fact clear, and refers to materials which are reworkable according to the teachings of the specification. As such, Applicants submit that the claims are definite within the meaning of 35 U.S.C. § 112, second paragraph. Withdrawal of the rejection is therefore respectfully requested.

Claims 1, 9-13, 17, 22-24, 49, and 53-56 have been rejected under 35 U.S.C. § 102(e) as allegedly being anticipated by U.S. Patent No. 6,265,776 to Gilleo. Further, claims 4-8, 14-16, and 18-21 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Gilleo and further in view of WIPO publication 00/56799 to Torres-Filho and U.S. Patent No. 6,208,525 to Imasu. Still further, claims 25-48, 50-52, and 57-61 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Gilleo, Torres-Filho, and Imasu, and further in view of U.S. Patent No. 6,168,972 to Wang et al. Each of these rejections is respectfully traversed.

The present invention is directed to a circuit chip provided with electrical contacts, and which further includes a fluxing agent and a distinct and separate curable thermosetting underfill material provided on the chip for mating the chip with a carrier substrate, and for providing an appropriate underfill material between the chip and the substrate upon mating and solder reflow. More particularly, through the present invention, the circuit chip can be provided with an appropriate fluxing agent which is disposed directly on electrical contacts on the chip, as well as with a thermosetting underfill composition which is distinct from the fluxing agent, and which is capable of fully curing under appropriate conditions so as to adhere the chip die to a substrate and provide an appropriate underfill material between the chip die and the substrate upon attachment thereto. The thermosetting underfill composition can be applied to the chip die and partially cured, such as through B-staging, due to the nature of the underfill material being a thermosetting composition, which can then be fully cured upon solder reflow during the attachment of the chip die to the substrate.

The Office Action contends that Gilleo teaches a chip die having electrical contacts thereon including a fluxing agent disposed on the surface of the electrical contacts, and a curable thermosetting underfill composition dispensed in a flowable form over the chip

die about the electrical contacts. Contrary to that contention, however, Gilleo is not directed to curable thermosetting underfill compositions. Instead, the teachings of Gilleo as a whole are directed to the use of thermoplastic materials instead of thermoset underfill materials.

More particularly, the entire specification of Gilleo revolves around solving problems that are allegedly inherent with thermoset underfill materials. For example, Gilleo teaches the desirability of providing an underfill material that can soften and preferably melt (not controllably degrade) so as to allow the flip chip to be removed from the substrate upon failure. Gilleo specifically notes at column 6, lines 15-21 that “thermoset underfill materials do not allow the assembly to be reworked since thermosets cannot be melted once they have cross-linked. The present invention eliminates the problems associated with thermoset underfills by incorporating a thermoplastic resin as the main component of the underfill”. Clearly, Gilleo is directed to replacing thermoset underfill materials with thermoplastic underfill materials.

The claims of the present invention, on the other hand, require a curable thermosetting underfill composition as the underfill material. In the present invention, thermosetting underfill materials are desired due to the ability to be B-staged or partially cured, thereby providing the circuit chip as a separate structure including the fluxing agent and the partially cured thermosetting underfill composition in a solid form thereon, which can then be mated with the substrate and heated to reflow the electrical contacts and fully cure the thermosetting underfill material. Such thermosetting underfill materials are quite different from the thermoplastic underfill materials as taught by the Gilleo reference.

It is well settled law that a reference must be considered for all of its teachings, including disclosure that diverges and teaches away from the invention at hand as well as disclosures that point toward and teach the invention. *In re Dow Chem. Co.*, 837 F.2d 469, 5 USPQ2d 1529 (Fed. Cir. 1988). When Gilleo is considered as a whole, the reference clearly teaches away from the present invention by specifically noting that thermoset underfills are not particularly useful. In fact Gilleo as a whole describes how to eliminate the problems which are typically associated with thermoset underfill materials. With such clear and unequivocal teaching away, Gilleo does not anticipate the present invention, which clearly requires a thermosetting underfill material in the claims, and instead teaches away from the use of such thermosetting materials.

Moreover, while Gilleo notes at column 6, lines 31-34 that in a further embodiment, “the underfill may also include a B-staged thermoset that will depolymerize at an elevated temperature” (emphasis added), such teachings of thermoset materials are clearly meant to be in combination with thermoplastic underfill materials as the main component of the underfill (not as a substitute therefor). Gilleo therefore fails to disclose, teach or suggest the present invention which claims a thermosetting composition as the underfill material.

Moreover, the additional documents cited in combination with Gilleo fail to provide any teachings which would cure the deficiencies of Gilleo. In particular, the Torres-Filho publication relates to thermosetting resin compositions which are reworkable when subjected to appropriate conditions. Such reworkable thermosetting compositions are very different than the thermoplastic compositions taught by Gilleo. In fact, Gilleo specifically recognizes the differences between thermoplastic and thermoset underfills throughout Gilleo, specifically noting the problems associated with thermosets. And the Torres-Filho publication does not disclose, teach or suggest a pre-applied semiconductor circuit chip. Accordingly, the Torres-Filho publication is not properly combinable with the Gilleo reference. One skilled in the art, reading Gilleo for its entire teachings would not look to use thermosetting underfills, since Gilleo teaches that thermosets are problematic.

Imasu has merely been cited for its alleged teachings with respect to semiconductor chips made of silicon. As is apparent, however, Imasu fails in any way to teach or disclose a circuit chip in accordance with the present invention which involves distinct and separate fluxing agents and thermosetting underfill materials disposed on a chip. Accordingly, Imasu clearly fails to add any teachings to the deficiencies of Gilleo.

Wang has been cited with specific reference to a further embodiment of the present invention set forth in claim 25, where the underfill material comprises a first thermosetting underfill composition which is dispensed in flowable form over the chip die, and a second thermosetting underfill composition which is dispensed in flowable form over the first thermosetting underfill composition. Wang, however, fails to provide any teachings directed to this specific arrangement. More particularly, the Office Action refers to Figures 7A, 7B, 8A, 8B, 9A and 9B of Wang as disclosing a second thermosetting underfill composition dispensed in a flowable form over the first thermosetting underfill composition. However, these figures and the accompanying disclosure of Wang clearly do not involve

dispensing a second thermosetting underfill composition on a first thermosetting underfill composition, let alone rendering such compositions non-flowable on the chip surface. Instead, Wang clearly discloses providing separate underfill compositions on separate members, namely, on chip 200 and on substrate 300, followed by alignment and reflow to attach the chip and the substrate together through the underfill materials. Such teachings do not in any way teach or suggest the chip claimed in claim 25, which clearly requires a second thermosetting underfill composition dispensed over the first thermosetting underfill composition and rendered non-flowable thereon. With the embodiment described in claim 25, a specific circuit chip can be provided with all of the underflow material, including two distinct thermosetting underfill materials, on the chip itself, which can then be separately attached to a substrate, without the need for a separate underfill material applied to the substrate, as required in the cited teachings of Wang.

Moreover, Wang is clearly directed to thermosetting underfill materials, which, as noted above, Gilleo clearly teaches away from the use of. In fact, one skilled in the art reading Gilleo would not be inclined to use thermosetting materials due to the specific problems associated with such thermosetting underfill materials as noted in Gilleo.

It is apparent that the cited documents fail to disclose, teach or suggest the invention as defined by the present claims, involving a chip die having a fluxing agent disposed on electrical contacts on the chip die, and a curable thermosetting underfill composition disposed on the chip die about the electrical contacts and rendered non-flowable, so as to provide an integrated circuit chip assembly for direct attachment to a substrate.

In sum, it is apparent that Gilleo specifically teaches away from this concept by disclosing that thermoset underfill materials are not particularly useful and inherently have problems, and suggesting that thermoplastic materials must be used as the main component of the underfill. One skilled in the art, reading the teachings of the Gilleo patent as a whole, would clearly not be motivated to provide a circuit chip with a thermosetting underfill material which does not include a thermoplastic material, particularly with Gilleo stressing the problems associated with thermosetting underfill materials. One reading Gilleo as a whole would not even be motivated to combine any of the secondary references of the Torres-Filho publication, Imasu, or Wang with the teachings of Gilleo, in view of the specific teaching away in Gilleo of using thermosetting underfill materials.

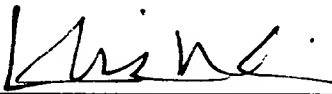
In view of the above remarks, it is apparent that Gilleo fails to teach the present invention which requires a curable thermosetting composition as the underfill material on a circuit chip assembly. Accordingly, withdrawal of the rejections under Sections 102(e) and 103 is appropriate and is respectfully requested.

It is further noted that a corresponding PCT international application has been filed directing to the same subject matter, and for which Examiner Chambliss has conducted preliminary examination under the PCT. It is noted that an International Preliminary Examination Report issued by Examiner Chambliss on June 19, 2003, specifically noting that claims 1-61 meet the criteria within the PCT for novelty and inventive step. In view of such recognition by the Examiner in the international application, it is submitted that the present U.S. application is also allowable. Favorable action with respect to the present U.S. application is therefore deemed appropriate and is respectfully requested.

The Examiner is invited to contact Applicants' undersigned representative by telephone to discuss any of the issues presented herein, or to further discuss the application.

Respectfully submitted,

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